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<p>(21) International Application Number: PCT/US80/00881 (22) International Filing Date: 14 July 1980 (14.07.80) (31) Priority Application Number: 066,958 (32) Priority Date: 16 August 1979 (16.08.79) (33) Priority Country: US  (71) Applicant: MOTOROLA, INC. [US/US]; 1303 East Algonquin Road, Schaumburg, IL 60196 (US). (72) Inventors: KRUMIN, Donald, Kenneth; 600 Middle River Drive, Fort Lauderdale, FL 33304 (US). TOIH, Richard, John; 1761 Southwest 13th Street, Boca Raton, FL 33432 (US). (74) Agent: GILLMAN, James, William; Motorola, Inc., Patent Department, 1303 East Algonquin Road, Schaumburg, IL 60196 (US).</p>		<p>(81) Designated States: AT (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), JP, NL (European patent), SE (European patent)  Published With international search report</p>
<p>(54) Title: HOUSING FOR ELECTRONIC APPARATUS WITH ELASTOMER OUTER LAYER</p> <p>(57) Abstract</p> <p>Housing for electronic apparatus (10), such as a radio or paging device, including an enclosure (20, 22) made of a suitable rigid material, which may be metal or plastic (26), with resilient material (34) on the outside surface thereof. The resilient material may be a urethane elastomer which is thermoplastic and can be applied to the rigid material by injection molding. The elastomer can completely cover the enclosure, including a movable control element (14) thereon, to provide a rugged shock absorbing and scuff and contaminant resistant housing for the apparatus therein.</p> <div data-bbox="311 1144 1117 1801"> </div>		

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HOUSING FOR ELECTRONIC APPARATUS WITH  
ELASTOMER OUTER LAYERBackground of the Invention

Many small portable electronic devices are in use today which may be held in the hand of the user, and are subject to being dropped or otherwise jolted. This can scratch or otherwise damage the housing, and may cause  
5 serious damage to electronic components within the housing. To reduce the possibility of such damage to portable electronic devices, it is known to provide a case or cover for protecting the housing which may be made of leather or suitable synthetic flexible material. This involves the  
10 use of a separate element which adds to the size of the device, which may impede the use of the device, and which can be separated from the device and misplaced.

Another problem which exists in connection with the use of small hand-held electronic devices is that it may  
15 be difficult to hold or grasp the device, especially when the device is wet or cold, as when the device is used out of doors in inclement weather. Also, such devices generally include control elements which project from the housing, and there is a problem of sealing the same so that moisture  
20 or other foreign material cannot enter the housing and damage the apparatus therein. In addition to being scuffed and scratched when subjected to rough usage, housings for portable electronic devices can be damaged by contact with contaminants, such as salt and acids.

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Summary of the Invention

It is an object of this invention to provide an improved housing for a portable electronic device, which includes a rigid enclosure with resilient material molded thereto, on the outside surface thereof.

5 Another object of the invention is to provide a rugged housing for a hand-held electronic device having a soft outside surface to facilitate gripping the same, and which provides shock isolation for electronic components therein.

A further object of the invention is to provide a  
10 housing structure for a miniature electronic device, such as a radio, which includes a rigid enclosure having a thermoplastic elastomer molded to the outside surface thereof to provide a completely sealed housing which resists scuffs and scratches, and also damage from contact  
15 with contaminants.

The housing of the invention includes parts forming a rigid enclosure, which may be made of metal or a rigid plastic, with a soft outer layer which is bonded to the outside surface of the rigid enclosure parts. The outer  
20 layer may be an elastomer, such as thermoplastic urethane, which is injection molded about the rigid enclosure. The elastomer can cover control elements extending to the outside of the enclosure to completely seal the same, and will still allow operation of the elements because of its  
25 flexibility. The elastomer presents a pleasing appearance, makes it easy to grip and hold a portable electronic device, and provides shock isolation for the component of the device. The elastomer also resists scratches and scuffs and the effects of contaminants, such as salt and  
30 acid, to maintain its desirable appearance when the device is subjected to rough usage.

Brief Description of the Drawing

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Fig. 1 is a perspective view of a radio device having a housing in accordance with the invention;



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Fig. 2 is a view of the device of Fig. 1 showing the housing parts disassembled; and

Fig. 3 is a cross-section view along the lines 3-3 of Fig. 1, illustrating the molding of the elastomer of the housing.

#### Detailed Description of the Invention

Fig. 1 is a perspective view of a hand-held radio device 10 which includes a housing in accordance with the invention. The radio 10 can be a two-way radio which transmits waves modulated by sound signals applied to the grill 12 on the front of the device. The radio is operated to the transmitting condition by operation of the push-to-talk switch 14, as is well known. The radio waves developed by the transmitter are radiated by antenna 16. A control 18 can be used for many different known functions in such a radio device. For example, control 18 can be used to turn the radio on and off, and/or to adjust the audio volume or the squelch operation.

The radio device 10 can also include a radio receiver which is operative when the push-to-talk switch 14 is not operated. Radio waves are received by the antenna 16, and audio signals are derived therefrom by the radio receiver. Such audio signals may be applied by a speaker through the grill 12 so that they are heard by the user of the device.

Fig. 2 shows that the housing for the radio device 10 includes a main body 20 and a removable cover 22 which allows the placement of electronic apparatus therein and permits adjustment or servicing of the same. The cover 22 can be removably secured to the body 20 by screws 24, for example. The control know 18 can be removable, as is well known.

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Fig. 3 illustrates the construction of the body 20 of the housing of the radio device 10 of Fig. 1. The body includes a rigid member 26 which can be made of metal or a rigid plastic material. Fig. 3 shows a mold formed by parts 30 and 32 within which the member 26 is placed to apply the elastomer coating 34 thereon. The mold part 30 has projections 36 which engage the member 26 at the grill openings 12 so that the elastomer does not fill the openings. These are shown by dotted lines in Fig. 3, because they are below the elastomer coating 34. These projections 36 can also serve to position the member 26 in the mold. The mold part 30 has an opening 38 therein through which the thermoplastic elastomer can be injected into the mold cavity. A sprue 40 is connected to the mold part 30 for coupling to a standard injection molding machine. The sprue 40 communicates with opening 38 to form a continuous passage for the elastomer, which may be a thermoplastic urethane material which adheres to the outside surface of the member 26. One or more additional sprues 40 can be provided to inject the elastomer, at positions below the grill openings 12, for example. The mold cavity can include space for the antenna 16 which can be attached to the member 26 before the molding operation, so that the antenna is covered by elastomer.

Fig. 3 also illustrates the push-to-talk switch 14 and the elastomer coating thereover. As the elastomer is compressible, it does not prevent operation of the switch, and completely seals the same so that entry of foreign material is prevented. Fig. 3 further shows bosses 42 on the member 26 with threaded openings 44 to receive the screws 24 for holding the cover 22 to the body 20.

The cover 22 of the housing can also be formed of a rigid inner member with an elastomer outer layer. This can be provided in a mold generally like that shown in Fig. 3 but which can be very simple. The mold can include projections engaging the openings for the mounting screws

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and which also serve to position the rigid member in the mold. The control 18 can also have an elastomer coating thereon.

5       The structure described provides a housing that has  
a rigid inner enclosure to provide the necessary strength,  
with a resilient elastomer outer layer applied thereto  
by injection molding. The elastomer outer surface has a  
pleasing appearance and provides low reflectance so that  
the device is not conspicuous when used in public safety  
10      and surveillance applications. The elastomer provides  
shock isolation to components within the housing and also  
for the rigid parts of the housing to prevent cracking and  
breaking thereof. The elastomer resists scratches and  
scuff marks to prevent degradation of the appearance of  
15      the housing. Further the elastomer resists chemical  
attack on the housing surfaces, such as that caused by  
salt or acids.

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Claims

1. A housing for a portable electronic device including,

a rigid structure for enclosing electronic components therein, said structure having an outside surface,  
5 and

molded elastomer material on said outside surface of said rigid structure to form a rugged housing which provides shock isolation for the electronic components.

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2. A housing in accordance with claim 1 wherein the electronic device includes a movable control element extending at said outside surface, and wherein said molded elastomer material covers the control element.

- 5        3. A housing in accordance with claim 1 wherein said elastomer material is an injection molded urethane thermoplastic material.

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4. A housing for a portable radio device which includes a sound transducer, said housing including a rigid structure having an outside surface and openings for communicating with the sound transducer, and molded elastomer material
- 5 on said outside surface to form a resilient outer layer for said housing which provides shock isolation for the radio device.

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5. The structure of claim 4 further including an antenna secured to said rigid structure and wherein said elastomer material covers said rigid structure and said antenna in a continuous layer.

5        6. The structure of claim 4 further including switch means having an actuating element extending at said outside surface, and wherein said elastomer material covers said rigid structure and said actuating element and is flexible to allow movement of said actuating element.

10       7. The structure of claim 4 wherein said elastomer material is an injection molded urethane thermoplastic material, and said resilient outer layer has openings therein aligned with said openings in said rigid structure.

15       8. The structure of claim 4 further including a control for the radio device extending outside said rigid structure, and wherein said control has a coating of elastomer material thereon.

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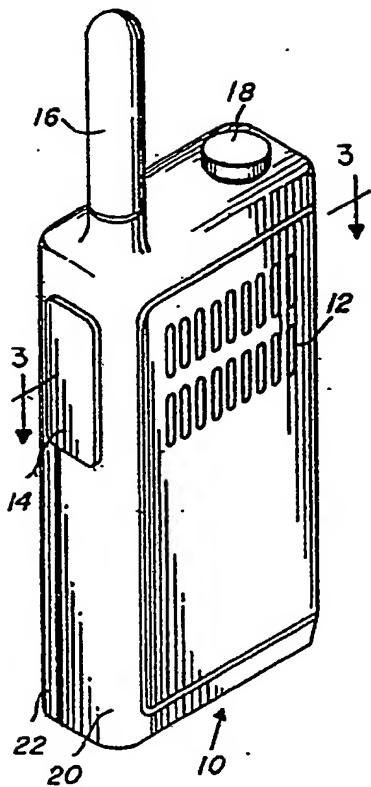


Fig. 1

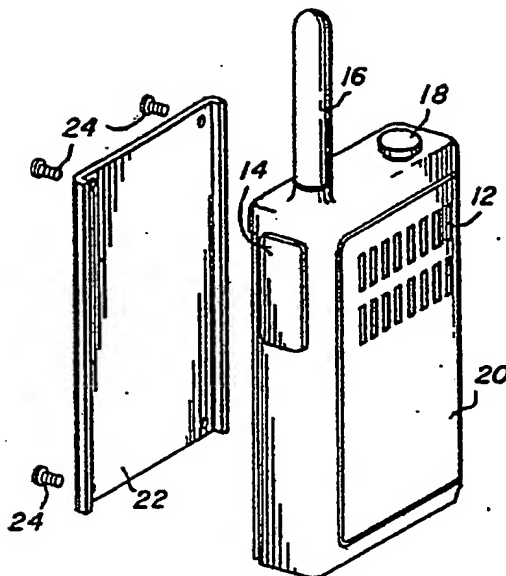


Fig. 2

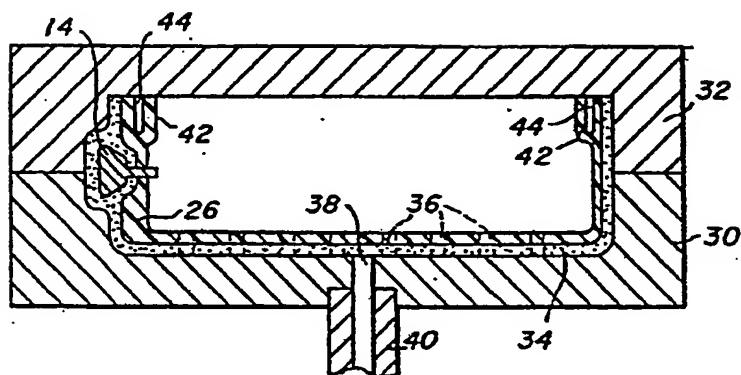


Fig. 3

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# INTERNATIONAL SEARCH REPORT PCT/US80/00881

International Application No.

## I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) \*

According to International Patent Classification (IPC) or to both National Classification and IPC

INT. CL. HO4B 1/08

U.S. 455/351

## II. FIELDS SEARCHED

### Minimum Documentation Searched \*

Classification System	Classification Symbols
U.S.	455/89,90,95,347,351; 179/184,115.5BS; 220/444,454,457; 361/422,380,399; 362/158; 364/708

Documentation Searched other than Minimum Documentation  
to the extent that such Documents are included in the Fields Searched \*

## III. DOCUMENTS CONSIDERED TO BE RELEVANT \*\*

Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages **	Relevant to Claim No. **
X	U S, A, 2,832,968, Published 6 May, 1958, Knudsen	1-8
X	U S, A, 4,053,943, Published 11 October, 1977, Galvin	1,3
X	U S, A, 3,345,568, Published 3 October, 1967, Enrichiello et al.	4-8
A	U S, A, 3,162,813, Published 22 December, 1964, Piccinini	4
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## IV. CERTIFICATION

Date of the Actual Completion of the International Search \*

October 23, 1980

Date of Mailing of this International Search Report \*

30 OCT 1980

International Searching Authority \*

ISA/US

Signature of Authorized Officer \*\*

*Jim F. Ng*

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